

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 0 635 549 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
11.06.1997 Bulletin 1997/24

(51) Int Cl.<sup>6</sup>: **C08L 83/04, C08K 7/22**

(21) Application number: **94110423.4**

(22) Date of filing: **05.07.1994**

(54) **Organosiloxane composition and method for preparing same**

Organosiloxan-Zusammensetzung und Herstellungsverfahren

Composition d'organosiloxane et la méthode de préparation

(84) Designated Contracting States:  
**DE FR GB**

(30) Priority: **06.07.1993 JP 191902/93**

(43) Date of publication of application:  
**25.01.1995 Bulletin 1995/04**

(73) Proprietor: **Dow Corning Toray Silicone  
Company, Limited  
Tokyo 103 (JP)**

(72) Inventors:  
• **Akamatsu, Shoji, Dow Corning Toray  
Ichihara-shi, Chiba Prefecture (JP)**

• **Kanzaki, Yasuo, Dow Corning Toray  
Ichihara-shi, Chiba Prefecture (JP)**

(74) Representative: **Spott, Gottfried, Dr.  
Spott, Weinmiller & Partner  
Sendlinger-Tor-Platz 11  
80336 München (DE)**

(56) References cited:  
**EP-A- 0 186 493 EP-A- 0 553 843**

• **DATABASE WPI Derwent Publications Ltd.,  
London, GB; AN 92-354802 & JP-A-4 258 646  
(ACHILLES) 14 September 1992**  
• **DATABASE WPI Derwent Publications Ltd.,  
London, GB; AN 92-354802 & JP-A-4 258 646**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

**EP 0 635 549 B1**

## Description

This invention relates to filled organosiloxane compositions and to a method for preparing the composition. More particularly, the present invention relates to organosiloxane compositions exhibiting excellent vibration-damping properties and to a method for their preparation.

Polyorganosiloxane oils, organosiloxane compounds, and organosiloxane gels are used as vibration-damping elements in optical read-out devices such as compact disks and laser disks; in magnetic read-out devices such as magnetic disks and "floppy" optical disks, referred to hereinafter as "floptical" disks; and in engineered equipment such as precision measurement devices. The organosiloxane compositions used in these applications range in consistency from oils to semi-solids and are typically composed of polyorganosiloxane oils and one or more fillers.

Liquid organosilicon compounds are particularly suitable as vibration-damping materials because they lack rubbery elasticity and because they can dampen external vibrations through internal friction within the organosiloxane compound itself as well as between the oil and a filler.

These compositions are exemplified by blends of finely divided inorganic particles with polyorganosiloxane oils, also referred to as "silicone oils", and are more fully described in by WO-A-8203086 (JP-A 57-168997) and JP-A 63-308241. Blends of a finely divided powdered organic resin with silicone oil is also described in JP-A 63-308242. A particular disadvantage of these compositions is their inadequate vibration-damping properties.

The present invention provides organosiloxane compositions that have excellent vibration-damping properties as compared to the foregoing prior art.

The disadvantages of the prior art for resin-filled, vibration-damping compositions are overcome by using as the filler finely divided hollow particles of a thermoplastic organic resin (containing a blowing agent) as the filler. These particles are obtained by heating resin particles containing a blowing agent in the presence of a polyorganosiloxane oil, thereby irreversibly expanding the resin particles.

The present invention introduces organosiloxane compositions comprising

- (A) from 70 to 99.9 weight percent of a polyorganosiloxane oil,
- (B) from 0.1 to 10 weight percent of finely divided hollow particles of a thermoplastic organic resin, having a particle size of 5 to 500  $\mu\text{m}$  and optionally
- (C) from 0 to 20 weight percent of a thickener.

The present invention also provides a method for preparing the present compositions, wherein said method comprises heating a composition at temperatures between 50 to 200  $^{\circ}\text{C}$

- (A) from 70 to 99.9 weight percent of a polyorganosiloxane oil,

- (B') from 0.1 to 10 weight percent of finely divided particles of a thermoplastic organic resin containing a blowing agent having a particle size of 5 to 500  $\mu\text{m}$ , whereby said particles become hollow by an irreversible expansion during said heating due to the generation of gaseous products from said blowing agent.

- (C) from 0 to 20 weight percent of a thickener

The polyorganosiloxane oil, ingredient A, is the basis new material of the organosiloxane composition of our invention. The molecular structure of ingredient A is not specifically restricted, and includes straight chain, partially branched straight chain, cyclic, and network structures. Straight-chain structures are particularly preferred.

The terminal groups present in the polyorganosiloxane oil are not specifically restricted when the molecular structure is a straight chain or a partially-branched, straight chain molecule. Suitable terminal groups include triorganosiloxy groups such as trimethylsiloxy, dimethylvinylsiloxy and dimethylphenylsiloxy; hydroxydiorganosiloxy groups such as hydroxydimethylsiloxy, hydroxymethylvinylsiloxy and hydroxymethylphenylsiloxy; and diorganohydrogensiloxy groups such as dimethylhydrogensiloxy and methylphenylhydrogensiloxy. Trimethylsiloxy and hydroxydimethylsiloxy are particularly preferred terminal groups. No specific restrictions apply to the silicon-bonded organic groups present in ingredient (A). These groups include alkyl radicals such as methyl, ethyl, propyl, butyl, pentyl and hexyl; alkenyl radicals such as vinyl, allyl, butenyl, pentenyl and hexenyl; aryl radicals such as phenyl, tolyl and xylyl; aralkyl radicals such as benzyl and phenethyl; and substituted radicals such as 3-chloropropyl and 3,3,3-trifluoropropyl.

Polyorganosiloxane oils suitable for use as ingredient A include:

trimethylsiloxy-endblocked dimethylpolysiloxanes, hydroxydimethylsiloxy-endblocked dimethylpolysiloxanes, dimethylvinylsiloxy-endblocked dimethylpolysiloxanes,

dimethylphenylsiloxy-endblocked dimethylpolysiloxanes,  
 trimethylsiloxy-endblocked methylphenylpolysiloxanes,  
 hydroxydimethylsiloxy-endblocked methylphenylpolysiloxanes,  
 dimethylvinylsiloxy-endblocked methylphenylpolysiloxanes,  
 5 trimethylsiloxy-endblocked methylvinylpolysiloxanes,  
 hydroxydimethylsiloxy-endblocked methylvinylpolysiloxanes,  
 trimethylsiloxy-endblocked dimethylsiloxane/methylphenylsiloxane copolymers,  
 trimethylsiloxy-endblocked dimethylsiloxane-methylvinylsiloxane copolymers,  
 trimethylsiloxy-endblocked methylphenylsiloxane-methylvinylsiloxane copolymers,  
 10 trimethylsiloxy-endblocked methyl(3,3,3-trifluoropropyl)-polysiloxanes,  
 cyclic dimethylpolysiloxanes,  
 cyclic methylvinylpolysiloxanes,  
 cyclic dimethylsiloxane-methylvinylsiloxane copolymers, and  
 cyclic dimethylsiloxane-methylphenylsiloxane copolymers.

15 Although the viscosity of ingredient A is not specifically restricted, there is a strong tendency for ingredient B to separate and aggregate when ingredient A has a viscosity at 25° C of below 100 centistokes ( $1 \times 10^{-4} \text{ m}^2/\text{s}$ ). When ingredient A has a viscosity in excess of 1,000,000 centistokes ( $1 \text{ m}^2/\text{s}$ ), the resulting organosiloxane composition is extremely difficult to handle. As a result, the preferred range for the viscosity of ingredient (A) at 25° C is from  $1 \times 10^{-4}$  to  $1 \text{ m}^2/\text{s}$ .

20 Ingredient A can be a single polyorganosiloxane oil or it may consist of a mixture of two or more polyorganosiloxane oils. Suitable mixtures include oils having different viscosities, and mixtures of oils containing different silicon-bonded organic groups.

25 Ingredient A constitutes from 70 to 99.9 weight percent of the present compositions. The final composition of this invention is difficult to handle and process when the concentration of ingredient A is less than 70 weight%, while the vibration-damping properties of the resulting silicone compound are sharply reduced when the concentration of ingredient A exceeds 99.9 weight%.

30 Ingredient B, which consists of hollow finely divided particles of a thermoplastic organic resin, is the ingredient that characterizes our claimed organosiloxane compositions. Ingredient B has a hollow structure, and no specific restrictions apply to the type of thermoplastic organic resin that forms the walls or partitions of this hollow structure. Suitable thermoplastic organic resins include:

homopolymers of vinylic monomers such as ethylene, propylene, styrene, vinyl acetate, vinyl chloride, vinylidene chloride, methyl methacrylate, acrylonitrile, butadiene, and chloroprene; copolymers of these vinylic monomers, such as vinylidene chloride-acrylonitrile copolymers, vinyl chloride-acrylonitrile copolymers, vinyl acetate-butadiene copolymers, 35 ethylene-propylene copolymers, styrene-butadiene copolymers, and ethylene-propylene-butadiene copolymers; polyamides such as nylon-6 and nylon-6,6; and polyesters such as polyethylene terephthalate.

40 The ingredients that occupy the hollow interior of ingredient B are also not specifically restricted and may include the blowing agent used to create the hollow particles, residues of the blowing agent, and replacement gases, such as air, nitrogen, helium, argon and neon that have replaced the blowing agent after volatilization and dissipation of the blowing agent.

The morphology of the particles of ingredient B is not specifically restricted and may be spherical, disk-shaped, or gourd-shaped. A spherical shape is preferred. The particle size of this ingredient is in the range of 5 to 500 micrometers because they yield organosiloxane compositions with particularly good vibration-damping properties.

45 Ingredient B constitutes from 0.1 to 10 weight percent of the present compositions. The vibration damping properties of the final organosiloxane composition are reduced when the concentration of this ingredient is less than 0.1 weight percent. At the other extreme, when the concentration of ingredient B exceeds 10 weight percent, it becomes difficult to blend this ingredient into ingredient A, and in particular, the resulting composition becomes very difficult to handle and process.

50 The thickener comprising ingredient C is an optional ingredient that inhibits separation of ingredients A and B, thereby improving the storage stability of the present compositions. Ingredient C is exemplified by finely divided silica with a specific surface area of at least  $50 \text{ m}^2/\text{g}$ , fumed titanium oxide, colloidal calcium carbonate, alumina, iron oxide, carbon black, and liquid polyethers.

55 Finely divided silica with a specific surface area of at least  $50 \text{ m}^2/\text{g}$  is preferred, and silica with a specific surface in the range of from  $100 \text{ m}^2/\text{g}$  to  $500 \text{ m}^2/\text{g}$  is particularly preferred. The morphology of ingredient C is not specifically restricted, and it may be, spherical, disk-shaped, or fibrous with spherical being preferred. The preferred finely divided silica encompassed by ingredient C is not specifically restricted, but it is exemplified by dry-process silica, calcined silica, wet-process silica, and silica aerogel.

The surface of the silica particles is preferably pre-treated with an organohalosilane, organoalkoxysilane, orga-

nosilazane, or an polyorganosiloxane such as organohydrogenpolysiloxane, hydroxydiorganosiloxy-endblocked dimethylsiloxane oligomer, hydroxydiorganosiloxy-endblocked methylvinylsiloxane oligomer, or a hydroxydiorganosiloxy-endblocked methylphenylsiloxane oligomer.

The ingredient C constitutes from 0 to 20 weight percent of the present compositions. When the concentration of this ingredient exceeds 20 weight percent, it becomes difficult to blend ingredients B and C into ingredient A. In addition, the resulting organosiloxane composition is extremely difficult to handle and process. It also exhibits reduced vibration-damping properties.

The vibration-damping organosiloxane compositions of this invention comprise ingredients A, B, and optionally C as described hereinabove. The compositions may also contain one or more of the following optional additives to alter the appearance, physical properties and other characteristics of the final organosiloxane composition.

According to a further embodiment, the present invention provides the use of a composition as defined above as a vibration-damping material.

Inorganic fillers, such as crystalline silica, diatomaceous earth, aluminosilicate, iron oxide, zinc oxide, and calcium carbonate are an example. These inorganic fillers can also be treated with an organohalosilane, organoalkoxysilane, organosilazane, or an polyorganosiloxane such as organohydrogenpolysiloxane, hydroxydiorganosiloxy-endblocked dimethylsiloxane oligomer, hydroxydiorganosiloxy-endblocked methylvinylsiloxane oligomer, hydroxydiorganosiloxy-end blocked or methylphenylsiloxane oligomer. Other optional additives include organic pigments; inorganic pigments; dyes; heat stabilizers; and flame retardants.

The properties of the organosiloxane compositions of this invention are not specifically restricted. For example, the consistency of the composition ranges from an oil to a semisolid, and it preferably ranges from an oil with a viscosity at 25° C of 500 mPa.s (centipoise) to a semisolid which is almost completely devoid of fluidity. Its properties should be selected as appropriate for the desired end use application.

No specific restriction apply to the method for preparing the present organosiloxane compositions. One method comprises mixing ingredients A, B, and C. They can also be prepared by mixing ingredients A and C to homogeneity with finely divided particles of a thermoplastic organic resin containing a blowing agent, ingredient B', that will yield ingredient B upon heating. The latter method is preferred for its efficiency in producing organosiloxane compositions in accordance with the present invention.

The combination of finely divided, solid thermoplastic organic resin and blowing agent, referred to in this specification as ingredient B', is the precursor of ingredient B and is converted to hollow particles by means of an irreversible thermally induced expansion. The solid resin particles contain a blowing agent.

Suitable resins for use in combination with a blowing agent as ingredient B' have been discussed in connection with ingredient B. No specific restrictions apply to the blowing agent used to generate the hollow resin particles referred to as ingredient B.

Suitable blowing agents included:

aliphatic hydrocarbons such as propane, butane, isobutane, pentane, hexane, heptane, and octane;  
aromatic hydrocarbons such as toluene and xylene; ketones such as acetone, methyl ethyl ketone, and methyl isobutyl ketone;  
ethers such as tetrahydrofuran, dimethyl ether, methyl ethyl ether, and diethyl ether;  
esters such as methyl acetate, ethyl acetate, and butyl acetate; other volatile liquids such as dimethyl sulfoxide; and compounds that generate a gas by thermal decomposition such as diazonium compounds.

When the combination of thermoplastic organic resin and blowing agent is heated at or above the softening point of the resin, the blowing agents become a gas or produce a gas and thereby irreversibly expand ingredient the resin particle, with the formation of the hollow resin particles referred to as ingredient B.

After forming the hollow thermoplastic organic resin particles, the blowing agent and/or its residues either remain in the interior of the particles or dissipate to the outside of the hollow particles and are replaced by the atmosphere surrounding the particles.

The morphology of the resin portion of ingredient B' is not specifically restricted and is exemplified by spherical, disk-shaped, and gourd-shaped. A spherical shape is preferred. While the particle size of the unexpanded resin is not specifically restricted, particle sizes in the range of from 1 to 100 micrometers are preferred.

Ingredient B' constitutes from 0.1 to 10 weight of the blend that is subsequently heated to prepare the present organosiloxane compositions. The vibration-damping properties of the corresponding organosiloxane compositions become worse at ingredient B' concentrations of below 0.1 weight percent. In contract, the final organosiloxane composition is difficult to handle when the concentration of unexpanded resin particles exceeds 10 weight percent.

The formation of finely divided hollow particles of a thermoplastic organic resin by the irreversible expansion of ingredient B' occurs upon heating a composition comprising the homogeneous mixture of ingredients A, B' and C in addition to any optional ingredients. This is a significant feature of the instant method.

The mixing sequence for ingredients A, B', and C is not specifically restricted and, may consist of mixing ingredient B' to homogeneity into ingredient A and then mixing ingredient C into the resulting composition; mixing ingredient C to homogeneity into ingredient A and then mixing ingredient B' into the resulting composition; or mixing ingredients A, B', and C together all at once.

Likewise, there are no specific restrictions on the temperature at which the blend of ingredients A, B', and C are heated. Any temperature that will induce the irreversible expansion of ingredient B' is suitable. For example, heating is carried out at least to the temperature at which the blowing agent portion of ingredient B' is converted to a gas.

Preferably carried out to at least the softening point of the thermoplastic organic resin in ingredient B'. This temperature is preferably in the range of from 50° C to 200° C, with the range of 80° C to 150° C being particularly preferred.

Procedures for heating the composition of ingredients A, B', and C include (i) heating a mixture of these ingredients while they are in the process of being blended to homogeneity and (ii) heating the already homogeneous composition without mixing.

No specific restrictions apply to the mixing device used to blend ingredients A, B' and C. Suitable mixing devices include planetary mixers, Ross mixers, and Hobart mixers. The particular mixing device used need not be equipped with a heater. When using a mixer without a heater, a homogeneous composition is first prepared from ingredients A, B', and C. Then, the resin particles of ingredient B' must be expanded by heating this composition in an oven or by exposing it to far infrared radiation.

The resultant organosiloxane composition is unique based on the presence of the finely divided particles of hollow thermoplastic organic resin. Because the present compositions have excellent vibration-damping properties and a low specific gravity, they can be used as a lightweight vibration-damping part or element. In addition, it can be enclosed or contained in a molding of, for example, natural or synthetic rubber or in a damper. Moreover, the organosiloxane compositions of this invention can be used as a vibration-damping part, a vibration-isolating part or another ingredient in optical read-out devices such as compact disks and laser disks; in magnetic read-out devices such as magnetic disks, "floptical" disks; and in engineered equipment such as precision measurement devices.

#### Examples

The following examples describe preferred embodiments of the present composition and method. Unless otherwise specified all parts and percentages in the examples are by weight and viscosities are the values measured at 25° C. The vibration-damping capacity of the compositions was evaluated by measuring tan delta, a function of the loss modulus and storage modulus of a material, using a Rheometrics RDA 700 dynamic analyzer from Rheometrics™ Incorporated.

#### Example 1

A dispersion of hollow, finely-divided powder of a thermoplastic organic resin in a liquid polyorganosiloxane was prepared by placing 1,920 g of a trimethylsiloxy-endblocked dimethylpolysiloxane exhibiting a viscosity 5,000 centistokes ( $5 \times 10^{-3} \text{ m}^2/\text{s}$ ) and 80 g of a finely divided vinylidene chloride-acrylonitrile copolymer in a heater-equipped stirring vessel. The particles of vinylidene chloride-acrylonitrile copolymer contained isobutane as a blowing agent, exhibited particle diameters of 16 to 32 micrometers, and had an expansion initiation temperature of 140° C.

The mixture of resin and polyorganosiloxane was heated to 145° C while stirring to homogeneity, and was maintained at this temperature with stirring for an additional 10 minutes. Cooling of the reaction mixture yielded an organosiloxane composition of the present invention.

This silicone composition had a viscosity of 230 poise (23 Pa.s). The diameter of the hollow vinylidene chloride-acrylonitrile copolymer particles in the final composition were from 60 to 130 micrometers. Table 1 reports the vibration-damping performance of this organosiloxane composition.

When the organosiloxane composition was allowed to stand in a transparent glass container, no change in appearance occurred after 1 month at room temperature. After three months a portion of the hollow copolymer particles separated into an upper layer.

#### Example 2

An organosiloxane composition of this invention was prepared by placing 1,920 g of a trimethylsiloxy-endblocked dimethylpolysiloxane exhibiting a viscosity of 60,000 centistokes ( $60 \times 10^{-3} \text{ m}^2/\text{s}$ ) and 80 g of finely divided particles of a vinylidene chloride-acrylonitrile copolymer in a heater-equipped stirring vessel. The copolymer particles contained isobutane as blowing agent, exhibited particle diameters from 16 to 32 micrometers and an expansion initiation temperature of 140° C. A homogeneous material was prepared by stirring, was then heated to 145° C, and was maintained at this temperature for an additional 10 minutes. Cooling of the resultant material yielded a organosiloxane composition

of the present invention.

The hollow particles of vinylidene chloride-acrylonitrile copolymer that formed during heating exhibited particle diameters of 60 to 130 micrometers. Table 1 reports the vibration-damping performance of this organosiloxane composition. When the composition was allowed to stand in a transparent glass container, no change in appearance was observed following one month of storage at room temperature. After three months part of the hollow particles separated to form an upper layer.

### Example 3

A composition of this invention was prepared by placing the following ingredients in a heater-equipped stirring vessel: 1,910 g of a trimethylsiloxy-endblocked dimethylpolysiloxane exhibiting a viscosity of 10,000 centistokes ( $1 \times 10^{-2} \text{ m}^2/\text{s}$ ), 10 g of finely divided particles of a vinylidene chloride-acrylonitrile copolymer, and 80 g of fumed silica exhibiting a specific surface area of  $200 \text{ m}^2/\text{g}$ .

The particles of vinylidene chloride-acrylonitrile copolymer contained isobutane as blowing agent, exhibited particle diameters from 10 to 20 micrometers, and had an expansion initiation temperature of  $80^\circ \text{C}$ .

The mixture of copolymer particles and dimethylpolysiloxane was heated to  $85^\circ \text{C}$  while stirring to homogeneity, and was maintained at this temperature with stirring for an additional ten minutes. It was allowed to cool to yield an organosiloxane composition of the present invention. The viscosity of the composition was 150 poise (15 Pa.s)

The hollow copolymer particles exhibited diameters of from 35 to 85 micrometers.

Table 1 reports the vibration-damping performance of this organosiloxane composition as tan delta values. When the silicone compound was allowed to stand in a transparent glass container, no change in appearance occurred after 3 months at room temperature.

### Examples 4 to 6

Three organosiloxane compositions of the present invention were prepared by placing the following ingredients in a heater-equipped stirring vessel:

1,910 g of a trimethylsiloxy-endblocked dimethylpolysiloxane exhibiting a viscosity of 10,000 centistokes ( $1 \times 10^{-2} \text{ m}^2/\text{s}$ ), finely divided particles of a vinylidene chloride-acrylonitrile copolymer in the quantity reported in Table 1, and a fumed silica exhibiting a specific surface area of  $200 \text{ m}^2/\text{g}$  in the quantity reported in Table 1. The surface of the silica particles had been treated with dimethyldichlorosilane

The vinylidene chloride-acrylonitrile copolymer particles contained isobutane as blowing agent, had particle diameters of 10 to 20 micrometers, and had an expansion initiation temperature of  $80^\circ \text{C}$ . Each of the mixtures of copolymer particles and dimethylpolysiloxane was heated to  $85^\circ \text{C}$  while stirring to homogeneity, and was maintained at this temperature for ten minutes while stirring was continued. The three mixtures were then allowed to cool to yield compositions of the present invention.

The hollow copolymer particles in each of the compositions exhibited particle diameters of from 35 to 85 micrometers. Table 1 reports the vibration-damping performance of the three organosiloxane compositions.

When Examples 4, 5 and 6 were allowed to stand in transparent glass containers, no change in appearance occurred after 1 month at room temperature. After standing for three months a portion of the copolymer particles in the composition that did not contain fume silica separated to form an upper layer.

### Comparative Example 1

1,400 g trimethylsiloxy-endblocked dimethylpolysiloxane with a viscosity of 10,000 centistokes ( $1 \times 10^{-2} \text{ m}^2/\text{s}$ ) was introduced into a heater-equipped stirring vessel. A homogeneous composition was prepared by the introduction with stirring of 600 g of fumed silica exhibiting a specific surface area of  $200 \text{ m}^2/\text{g}$ . The surface of the silica particles had previously been treated with dimethyldichlorosilane in three portions. The resultant mixture was stirred while being heated at  $140^\circ \text{C}$  under a pressure of less than 1.3 kPa (10 mm Hg) or less for 10 minutes to yield a silicone compound with a viscosity of approximately 1000 Pa.s.

The vibration-damping properties of this organosiloxane composition outside the scope of the present invention are reported in Table 1 as tan delta values.

### Comparative Example 2

1.1 kg of a trimethylsiloxy-endblocked dimethylpolysiloxane with a viscosity of 5,000 centistokes ( $5 \times 10^{-3} \text{ m}^2/\text{s}$ ) was introduced into a heater-equipped stirring vessel. A composition was prepared by the introduction while stirring of 0.9 kg of a powdered silicone resin exhibiting particle diameters from 20 to 200 micrometers and an average particle

diameter of 80 micrometers. The vibration-damping properties of this organosiloxane composition are reported in Table 1 as tan delta values.

#### Comparative Examples 3 to 5

5

Homogeneous compositions outside the scope of the present invention were prepared by introducing 1,400 g of a trimethylsiloxy-endblocked dimethylpolysiloxane with a viscosity of 10,000 centistokes ( $1 \times 10^{-2} \text{ m}^2/\text{s}$ ) into a heater-equipped stirring vessel and by then introducing into the vessel with stirring the quantities of fumed silica reported in Table 1. The silica exhibited a specific surface area of  $200 \text{ m}^2/\text{g}$  reported in Table 1. The silica had been pre-treated with dimethyldichlorosilane.

10

The resultant mixtures were in each case heated with stirring at  $140^\circ \text{C}$  under a pressure of less than 1.3 kPa (10 mm Hg) to yield three organosiloxane compositions outside the scope of the present invention. These are referred to as comparative examples 3, 4, and 5.

The vibration-damping properties of the three compositions are reported in Table 1 as tan delta values.

15

20

25

30

35

40

45

50

55

Table 1

	Present						Comparative Examples				
	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4	Comp. Ex. 5
<u>Composition (wt %)</u>											
Polyorganosiloxane	96	96	95.5	90	94.5	95	70	55	93	92	90
Hollow Resin Particles	4	4	0.5	5	2	5	-	-	-	-	-
Silica	-	-	4	5	3.5	-	30	-	7	8	10
Organosiloxane Resin Particles	-	-	-	-	-	-	-	45	-	-	-
<u>tan delta values</u>											
0.1 Hz	9.622	8.694	9.851	7.643	11.54	10.38	0.874	3.593	3.070	3.752	3.202
1.0 Hz	18.59	18.35	18.65	24.82	16.63	14.49	1.007	13.30	6.795	6.277	5.711
10.0 Hz	34.70	29.79	23.43	46.25	10.67	13.37	1.726	25.97	6.022	6.215	5.652

## measurement conditions:

plate diameter : 20 mm  
 frequency: 0.1 Hz, 1.0 Hz, 10 Hz  
 strain : 10%  
 sample thickness : 0.6 mm



**Claims**

1. A resin-filled organosiloxane composition comprising

(A) from 70 to 99.9 weight percent of a polyorganosiloxane oil,  
 (B) from 0.1 to 10 weight percent of finely divided hollow particles having a particle size in the range of 5 to 500  $\mu\text{m}$  of a thermoplastic organic resin, and optionally  
 (C) from 0 to 20 weight percent of a thickener.

2. The use of a composition according to claim 1 as a vibration-damping material.

3. A method for preparing an organosiloxane composition according to claim 1, said method comprising heating a mixture comprising

(A) 70 to 99.9 weight percent of a polyorganosiloxane oil,  
 (B') 0.1 to 10 weight percent of a finely divided thermoplastic organic resin containing a heat-activated blowing agent, having a particle size in the range of 5 to 500  $\mu\text{m}$  and optionally  
 (C) 0 to 20 weight% thickener

wherein said mixture is heated at temperatures of 50 to 200 °C, sufficient to activate said blowing agent, resulting in an irreversible expansion of said resin particles.

4. A method according to claim 3 wherein said oil is a trimethylsiloxy- or hydroxydimethylsiloxy-terminated polyorganosiloxane; the silicon-bonded organic groups present on said oil are selected from alkyl, alkenyl, aryl, aralkyl and substituted alkyl radicals; the viscosity of said oil is from  $1 \times 10^{-4}$  to 1  $\text{m}^2/\text{s}$ ; said resin is selected from homopolymers and copolymers of vinylic monomers, polyamides and polyesters; said thickener is selected from finely divided silica exhibiting a specific surface area of 50 - 500  $\text{m}^2/\text{g}$ , fumed titanium dioxide, colloidal calcium carbonate, alumina, iron oxide, carbon black and liquid polyether resins; and said blowing agent is selected from aliphatic hydrocarbons, aromatic hydrocarbons, ketones, ethers, esters, dimethyl sulfoxide, and compounds that generate a gas during a thermally induced decomposition.

**Patentansprüche**

1. Mit Harz gefüllte Organosiloxanzusammensetzung umfassend

(A) 70 bis 99,9 Gew.-% eines Polyorganosiloxanöls,  
 (B) 0,1 bis 10 Gew.-% feinverteilte hohle Teilchen mit einer Teilchengröße im Bereich von 5 bis 500  $\mu\text{m}$  aus einem thermoplastischen organischen Harz und gegebenenfalls  
 (C) 0 bis 20 Gew.-% eines Verdickungsmittels.

2. Verwendung einer Zusammensetzung nach Anspruch 1 als schwingungsdämpfendes Material.

3. Verfahren zur Herstellung einer Organosiloxanzusammensetzung nach Anspruch 1, wobei das Verfahren umfaßt, daß man eine Mischung umfassend

(A) 70 bis 99,9 Gew.-% eines Polyorganosiloxanöls,  
 (B') 0,1 bis 10 Gew.-% eines feinverteilten thermoplastischen organischen Harzes mit einem durch Wärme aktivierten Treibmittel mit einer Teilchengröße im Bereich von 5 bis 500  $\mu\text{m}$  und gegebenenfalls  
 (C) 0 bis 20 Gew.-% Verdickungsmittel,

erhitzt, wobei die Mischung auf eine Temperatur von 50 bis 200°C erhitzt wird, die ausreicht, um das Treibmittel zu aktivieren, was zu einer irreversiblen Expansion der Harzteilehen führt.

4. Verfahren nach Anspruch 3, worin das Öl ein Polyorganosiloxan mit Trimethylsiloxy- oder Hydroxydimethylsiloxy-endgruppen ist; die in dem Öl vorhandenen siliciumgebundenen organischen Gruppen ausgewählt sind aus Alkyl-,

Alkenyl-, Aryl-, Aralkyl- und substituierten Alkylresten; die Viskosität des Öls  $1 \times 10^{-4}$  bis  $1 \text{ m}^2/\text{s}$  ist, das Harz ausgewählt ist aus Homopolymeren und Copolymeren von vinylischen Monomeren, Polyamiden und Polyestern; das Verdickungsmittel ausgewählt ist aus feinverteiltem Siliciumdioxid mit einer spezifischen Oberfläche von 50 bis  $500 \text{ m}^2/\text{g}$  gebranntem Titandioxid, kolloidalem Calciumcarbonat, Aluminiumoxid, Eisenoxid, Ruß und flüssigen Polyetherharzen und das Treibmittel ausgewählt ist aus aliphatischen Kohlenwasserstoffen, aromatischen Kohlenwasserstoffen, Ketonen, Ethern, Estern, Dimethylsulfoxid und Verbindungen, die ein Gas während einer thermisch induzierten Zersetzung erzeugen.

## 10 Revendications

### 1. Composition d'organosiloxanes comportant une charge de résine comprenant

(A) de 70 à 99,9 pour cent en poids d'une huile de polyorganosiloxane

(B) de 0,1 à 10 pour cent en poids de particules creuses finement divisées ayant une taille de particules comprise dans l'intervalle de 5 à  $500 \mu\text{m}$ , d'une résine organique thermoplastique, et facultativement

(C) de 0 à 20 pour cent en poids d'un agent épaississant.

### 2. Utilisation d'une composition selon la revendication 1 comme matériau amortissant les vibrations.

### 3. Procédé de préparation d'une composition d'organosiloxanes selon la revendication 1, ledit procédé comprenant le chauffage d'un mélange comprenant

(A) de 70 à 99,9 pour cent en poids d'une huile de polyorganosiloxane,

(B') de 0,1 à 10 pour cent en poids d'une résine organique thermoplastique contenant un agent de soufflage activé thermiquement, ayant une taille de particules comprise dans l'intervalle de 5 à  $500 \mu\text{m}$ , et facultativement

(C) de 0 à 20% en poids d'un agent épaississant,

dans lequel ledit mélange est chauffé à des températures de 50 à  $200^\circ \text{C}$ , suffisantes pour activer ledit agent de soufflage, conduisant à une expansion irréversible desdites particules de résine.

### 4. Procédé selon la revendication 3, dans lequel ladite huile est un polyorganosiloxane terminé par des groupes triméthylsiloxyles ou hydroxydiméthylsiloxyles ; les groupes organiques liés au silicium présents sur ladite huile sont choisis dans le groupe constitué des radicaux alkyles, alcényles, aryles, aralkyles et alkyles substitués ; la viscosité de ladite huile est de $1 \times 10^{-4}$ à $1 \text{ m}^2/\text{s}$ ; ladite résine est choisie dans le groupe constitué des homopolymères et des copolymères de monomères vinyliques, des polyamides et des polyesters ; ledit agent épaississant est choisi dans le groupe constitué des silices finement divisées présentant une surface spécifique de 50 à $500 \text{ m}^2/\text{g}$ , du dioxyde de titane de fumée, du carbonate de calcium colloïdal, de l'alumine, de l'oxyde de fer, du noir de carbone et des résines de polyéther liquides ; et ledit agent de soufflage est choisi dans le groupe constitué des hydrocarbures aliphatiques, des hydrocarbures aromatiques, des cétones, des éthers, des esters, du sulfoxyde de diméthyle et des composés qui génèrent un gaz pendant une décomposition induite thermiquement.